HOST: Since the beginning of the pandemic, there have been a lot of questions about how COVID-19 deaths are tracked and how they are entered onto the death certificate. Joining us to talk about those topics is Robert Anderson, Chief of Mortality Statistics at NCHS.

HOST: There are two CDC sources of COVID-19 deaths. Could you talk a little bit about each source - what they are and what role they play in providing key information about the pandemic?

ROBERT ANDERSON: Sure - there are two main sources for COVID-19 deaths. The first piece is the case surveillance system which is built on the national notifiable diseases surveillance system. So anytime that there's what's called a reportable disease - these are things like measles or mumps or things that are of significant public health import - a case report has to be filed. And of course at the beginning of the COVID-19 pandemic it was decided that COVID-19 would be a reportable disease as well. So anytime any health care provider comes across a COVID-19 case they're supposed to file a case report with the state health Department, with the County Health Department – it varies from state to state - so on that form there is a line that asks did the patient die from this disease. It is capturing the fact of death from that particular disease. So the case surveillance system then collects these reports and then aggregates them - they also do some, for those states that are really slow in sending reports, they also scrape websites in order to get numbers that they can report in a timely fashion. The second source is from vital statistics and these data are based on death certificates. And the death certificate is filled out typically by a funeral director who provides demographic personal information and then physician/ medical examiner/coroner provides the cause of death information. And these are permanent legal records of the fact of death and the cause of death, and so they take a little bit more time to complete. These have to be done in a certain, specific way and they have to be done correctly. And so it takes a little bit longer. In general the death certificates lag the case reports by about two weeks on average, although that does vary quite a bit from state to state.

HOST: For the death certificate, NCHS issued a guidance report - a guidance document - for certifiers on how to include COVID-19 on the death certificate. That came out about a year ago. Can you talk about that a little bit?

ROBERT ANDERSON: Sure. At the beginning of the pandemic, we realized that we had an opportunity to reach out to physicians to help them understand how to complete the death certificate - in general, not just with regard to COVID-19. And so we created this document that was specific to COVID-19 that showed them how to fill out the death certificate properly in general, and then once they determined that COVID-19 was either the cause of death or a contributing factor, how to report it on the death certificate. This guidance just sort of builds on guidance that we issued several years earlier - I think the last time we issued guidance, general guidance, was in 2003. This guidance is essentially the same - it's just specific to COVID-19. This builds on the guidance that we issued before.

HOST: Turning to another topic here: comorbidities, other conditions contributing or involved with COVID-19 deaths. There was some confusion about the note on Table 3 on the website on COVID-19 deaths by contributing condition. The note says “For 6% of these deaths COVID-19 was the only cause mentioned on the death certificate.” And this has led to some wild and

inaccurate speculation that the other 94% of the deaths may have been really some other cause of death and not COVID-19. Could you talk about that a little bit?

ROBERT ANDERSON: Yeah sure. I can provide a little bit of background here. The cause of death section on the death certificate is designed in a specific way and it's designed to elicit a sequence of events leading to death. And then also to gather any significant conditions that contributed to death. So you have Part One about "cause of death" section which asks the certifier to provide the causal sequence. And so you would start on the top line and you would put the immediate cause of death. To use a COVID-19 example, you might have "respiratory distress syndrome" which is a common complication of COVID-19. And then you would work backwards from that immediate cause of death. And let's suppose that respiratory distress was brought on by pneumonia, viral pneumonia, and so you would put on the second line "viral pneumonia." And then on the third line - because we want to know what the cause of viral pneumonia was - if it was COVID-19, then you would write COVID-19 on the third line. So you'd have respiratory distress due to viral pneumonia due to COVID-19. That's a logical causal sequence from the immediate cause working back to the underlying cause. And then in Part Two, you could put any other conditions that might have contributed to death but weren't part of that causal pathway in Part One. Now with a disease like COVID-19, it should be fairly unusual to see only COVID-19 reported - I mean normally we should at least see the complications caused by the disease, such as pneumonia or respiratory distress. In cases where only COVID-19 is reported, the certifier is indicating that COVID-19 was the cause of death, but really they left it - the cause of death statement - somewhat incomplete. They neglected to provide the entire causal pathway. Now with regard to the other 94% which mentioned other diseases or conditions, it's important to understand that in the overwhelming majority of these cases the additional diseases or conditions are either complications of COVID-19 - they are in the causal pathway, like pneumonia or respiratory distress - or they're reported in Part Two as contributing conditions. So for about 92% of the deaths involving COVID-19 that mention other conditions - 91 or 92% - the certifiers indicated that COVID-19 is the primary or underlying cause. This is not a situation where the certifier is writing all of the diseases that the person had equally; they're actually reporting it in this causal sequence. And in the overwhelming majority of cases, COVID-19 has been indicated as the cause of the death. It's the cause that started that causal pathway, that causal sequence leading to death.

HOST: So to summarize, in some cases COVID-19 leads to complications such as pneumonia which can lead to death, and then in other cases a person already has a pre-existing condition - maybe diabetes or COPD - and in those cases COVID-19 can then cause serious illness and death in those individuals. Is that correct?

ROBERT ANDERSON: That's essentially correct. In almost all cases COVID-19 leads to some other complications, even if there are pre-existing chronic diseases. So for those that die from COVID-19, COVID almost always initiates a sequence of conditions and those can include respiratory, cardiovascular, neurological complications. And then the pre-existing chronic diseases seem to make things much worse and do seem to make people more prone to having a serious illness or death.

HOST: Now in cases where a person dies from another condition such as terminal cancer… end-stage Alzheimer's… something like that… but the person might contract COVID near the end of their life - is it then strictly a judgment call as to what role COVID-19 actually played in the death?

ROBERT ANDERSON: There are certainly circumstances with the role of COVID-19 is not clear. And in such cases the certifier does have to make a judgment call based on his or her training and expertise. They have to sort out what the causal sequence leading to death was and whether COVID-19 started that sequence, whether it was just a contributing factor or whether it wasn't a factor at all. So they have it's kind of sort things out and it's not easy when you have somebody who has a terminal disease. I mean, essentially what they have to do is figure out: OK, what did this person die from? What caused them to die when they died? So, you know, let's say somebody had terminal cancer and they had six months to live. And then they got COVID-19, let's say at the three month mark. Then the certifier would have to decide: OK, well would this person have survived longer with the terminal cancer if it weren't for COVID-19, and if the answer is no then the terminal cancer could probably be reported as the cause of death. If the answer is yes, then COVID-19 could be reported as the cause of death. But ultimately it comes down to the best medical opinion of the certifier.

HOST: Another example that has confused people in the past: someone is in a car crash and maybe the victim had COVID or develops COVID, and people get confused - how can COVID be responsible for somebody who's been injured in a car crash? What will you tell folks who are confused about that?

ROBERT ANDERSON: Well it really depends on the circumstances. In cases where the death is clearly the result of trauma caused by the crash, whether the decedent had COVID-19 or not should be irrelevant. COVID-19 is not a factor in those cases. Now, in these cases it should not be counted as COVID-19 deaths - because the trauma caused the death, not any sort of viral infection that person might have had. However, we do know of cases where people have been hospitalized with serious but not life-threatening trauma from a car crash, who contracted COVID-19 in the hospital and then subsequently died as result of COVID-19. So in a case like that the crash and the trauma might be a contributing factor, but the underlying cause was COVID-19. So that was the primary cause of death because that's what caused them to die when they died - it wasn't the trauma. So it's complicated and it does depend on the circumstances.

HOST: Is there any follow-up analysis planned on these types of deaths to suggest whether COVID was really the cause or just happened to be present?

ROBERT ANDERSON: Following back on hundreds of thousands of cases that we that we have isn't really practical, but we have done some work to look at the causal sequences to see if these generally make sense, and in the overwhelming majority of deaths the certifiers are clearly indicating that COVID-19 was the cause of death. And so these are cases where certifiers are saying that the death was from COVID-19. So instructions on death certificates in the guidance we provided make it clear that COVID-19 should be reported if it caused or contributed to death in some way. A positive COVID-19 test is not by itself a sufficient criteria to warrant reporting

on the death certificate – the certifier has to indicate the role of COVID-19 as a cause or contributor. So to the extent instructions are followed we should only be counting deaths from COVID-19.

HOST: On the other side, you have - during the initial surge in COVID-19 deaths in the early spring of 2020 - there was also a surge in non-COVID-19 deaths from causes such as heart disease and other leading causes of death. Is that correct?

ROBERT ANDERSON: Yeah, as COVID-19 deaths were surging in the spring there was also at the same time a surge in deaths due to some cardiovascular diseases, to pneumonia and diabetes and also dementia. Those are the main conditions that surged at the same time. And it's possible that at least some of these deaths should have been attributed to COVID-19 but were not.

HOST: Has there been any follow-up analysis of those non-COVID-19 deaths that conclude that there were even more COVID deaths than what the numbers say?

ROBERT ANDERSON: Yeah we've done some analysis of excess deaths during the pandemic and I think we're going to talk about that just a little bit later. In addition, there is some work underway to try to quantify any underreporting, but it's likely that we're going to need more complete data by cause of death before we can say anything more definitively. It's likely that you'll get under-reported COVID-19 deaths mixed with indirectly- related deaths and it's fairly complicated to separate the two.

HOST: So now you mentioned excess deaths - what are excess deaths, how has COVID-19 contributed to these excess deaths?

ROBERT ANDERSON: So excess deaths are defined as the difference between the observed number of deaths in a specific time period and the expected or normal number of deaths in the same time period. So with the pandemic we're looking at the total number of weekly deaths that occurred in 2020 and so far in 2021, and we're comparing it with what we would expect in a comparable time period, essentially based on average weekly data from previous years. The advantage of looking at excess deaths is that it's not dependent on the accuracy of cause of death reporting - the focus is just on the total deaths, not deaths by cause. Now at this point COVID-19 explains about 3/4 of total excess deaths and the other quarter likely includes three components: there are deaths that should have been attributed to COVID-19 but were instead attributed to some other cause for whatever reason. Second, indirect deaths. And these are deaths that can be attributed to the circumstances of the pandemic but not directly to the virus. And this may be things like people not able to get health care during a crisis not related to the virus. Or perhaps they're afraid to seek care because the hospitals are full of people with COVID. And then, three: a third component is other causes of excess deaths. So you know there may be some excess deaths not associated with pandemic. This could include things like deaths due to natural disasters. This is generally going to be relatively small in comparison to what we're dealing with the pandemic but these are sort of another category of excess deaths.

HOST: There was some other speculation out there - rumors or what have you - that 2020 might have been actually a normal year in terms of total mortality in comparison to past years despite COVID-19. How were people getting confused about that?

ROBERT ANDERSON: Yeah the problem was that some folks were comparing incomplete counts for 2020 with complete counts for earlier years. And so it did look like there were about a normal number of deaths. The problem was that they weren't including all of the deaths that occurred for 2020. So we've made some changes to our website to try to make it more clear what the total number of deaths were for 2020.

HOST: So NCHS ranks leading causes of death according to the underlying cause of death, and you mentioned earlier that in 92%, approximately, of COVID-19 related deaths, COVID-19 was listed as the underlying cause of death. And in roughly the other 8% of COVID-19 related deaths COVID-19 was not listed as the underlying cause of death. Could you talk about that a little bit?

ROBERT ANDERSON: Sure. Let me start by saying that leading causes are ranked by the total number of deaths, and it's based on a standard cause of death tabulation list that we typically used. And if folks are interested in that we have a publication called "Deaths: Leading Causes for… insert the year - I think the most recent one that we have published right now is for 2018 -but you get the idea of exactly how NCHS does the rankings and how all of that came about. Now when tabulating and comparing causes of death it's important that we assign a single cause to each death so that we don't double count. We don't want to have deaths falling into multiple categories, so we select a single cause. And as we discussed earlier, certifiers typically report more than one condition on death certificates. Now fortunately, as we also discussed, the death certificate is designed to elicit the single underlying cause, and that's defined as the disease or injury that initiated that sequence of events leading to death. That sequence gets reported in Part One on the certificate, and if completed correctly the underlying cause will be at the beginning of the sequence on the lowest use line in Part One. So as I mentioned before you could have a sequence like respiratory distress due to viral pneumonia due to COVID-19. That's a logical sequence starting with the immediate cause - which is respiratory distress - and then working backwards through viral pneumonia, back to COVID-19, which is the underlying cause. So that is the condition then that we would select for tabulation when comparing causes of death. Now if the certificate is not completed correctly - and this does happen - we actually have a set of standardized selection rules to choose the best underlying cause for among those conditions listed. These rules are part of ICD-10, which we used to code mortality, and they're an international standard. So the all those rules get applied regardless of the cause of death in the same way and as a result we would select an underlying cause from among those conditions, assuming that the certificate is not completed correctly. Now with regard to the other 8 or 9 percent - I think it's something on the order of 91 point-something percent, underlying cause and then about 8 point-something percent not underlying cause. In cases where COVID-19 is not the underlying cause, we're typically seeing it reported in Part Two as a significant contributing factor. So if reported in Part Two, it may not be the underlying cause. It should be considered a significant factor that contributed to death. And this is an important distinction – if COVID-19 is not a factor it's not supposed to be reported on the death certificate.

HOST: There have been a lot of reported cases where somebody with COVID-19 recovers but still has a lot of symptoms and complications lingering, perhaps weeks or months, and then in a hypothetical situation if a person then eventually died even though they had recovered from COVID-19, would COVID-19 still be listed as the underlying cause of death or should that be the case?

ROBERT ANDERSON: Generally it should be - it's not unusual actually for somebody to get COVID-19 and develop these complications, particularly the breathing problems. And they may linger on a ventilator for weeks. But in the meantime, the virus has run its course but the damage is done. And so some of these people die. And when that happens the certifier is supposed to think to themselves, "OK, what started the chain of events leading to death? What started that sequence?" And in a case like what you described, it would be the COVID-19 that started the sequence because that's what resulted in the damage to the lungs that caused them to have to be put on a ventilator and ultimately killed them. So regardless of whether the virus is still active, COVID-19 can be reported as the underlying cause of death. It's still the disease that initiated the sequence of events leading to death even if it's not active.

HOST: Now would that be the case as well in a non-COVID-19 situation? Let's just say somebody was in a car crash and had severe after-effects, health issues and what not, and then eventually at some point down the road they died from those complications. Would that also still be appropriate for 'motor vehicle crash' to be the underlying cause of death in that situation?

ROBERT ANDERSON: Yeah this is true regardless of the cause. I mean, to give another example that is not uncommon: Suppose a person is shot by another person but survives with serious complications from the bullet wound. If those complications result in death, even if it occurs years later, then the underlying cause would be homicide. And actually these sorts of cases would be investigated as a homicide as well.

HOST: And that's assuming that in that hypothetical, the person who shot them, it wasn't an unintentional shooting of course.

ROBERT ANDERSON: Well yes this would mean that they were shot on purpose, yes. So if any disease or injury results in long term complications that eventually cause death, it's that disease or injury that caused the fatal complications, that started the sequence this should be reported as the underlying cause.

HOST: OK so a lot of people, in the media in particular, have been anxious to see where COVID-19 ranks as a leading cause of death. But I'm curious about another potential issue looming down the road as far as the categorization of COVID-19, particularly with pneumonia because for years now pneumonia and influenza have been listed as one category. And that's due to the fact that influenza, like COVID-19, causes these complications like pneumonia that can lead to death. So what about all these deaths - I guess there's nearly half of COVID-19 deaths where pneumonia was involved. Is it something where we may likely see at some point a category called "COVID-19 and pneumonia" or how do you plan to sort of separate those?

ROBERT ANDERSON: Well you know the pneumonia and influenza category has been useful to us as an indicator for influenza mortality surveillance for decades. The emergence of COVID-19 has certainly complicated the situation from a surveillance standpoint. That said, with regard to standard cause of death tabulation and leading causes, those cases where COVID-19 is the cause of pneumonia will be reported as COVID-19 deaths. Leading causes are based on the underlying cause and so in this case COVID-19 would be the underlying cause. And the pneumonia and influenza category will only include those deaths where either pneumonia or influenza was the underlying cause. We couldn't combine pneumonia with both COVID-19 and influenza, otherwise we're going to be double counting deaths. So I don't see this for purposes of the leading causes being a big issue. It does complicate things from a surveillance standpoint but for leading causes of death, those cases where COVID-19 causes pneumonia will be in the COVID-19 category and the pneumonia and influenza will include those where pneumonia was the underlying cause or influenza was the underlying cause.

HOST: Now there are other strains of the virus out there now. Will it be possible via the death certificate to determine which strain of COVID-19 is responsible for the deaths moving forward?

ROBERT ANDERSON: It's really unlikely that we'll be able to distinguish between the strains of the virus in any meaningful way. Variants or strains of specific organisms such as viruses or bacteria are rarely reported on death certificates, so in most cases we would only have COVID-19 reported with no mention of the variant. And even if we did get the variant in some instances, because so much of it is likely to be more generally reported without mentioning the variant, we wouldn’t really be able to say anything about how many deaths are due to B117 or South African variant or what have you.